Lifting the Veil: The Science Behind the SSL Sound

When you hear an SSL, you hear the world with the veil lifted. This is no accident. In both the analogue and digital domains, we accept no compromise. This is why you shouldn’t either...

Solid State Logic has been a leader in console and audio tools for creative music production for 40 years. Over that time the company has gained a reputation for innovation, excellence, and service, and our products are held up as benchmarks for professional audio technology.

Our philosophy is simple. We spare nothing in designing and manufacturing the best precision music tools available anywhere. There is no single magic stage in any SSL product. Everything from the pre-amps to the conversion, digital processing, FX algorithms, and output stages plays its part.

In the analogue world we have unrivalled experience, knowhow, and legacy. Our SuperAnalogue technology is the practical, no compromise application of all those things, either in complete products, or the analogue stages of our digital consoles and interfaces.

In the digital world, SSL has over three decades of development behind it for the music, live, and broadcast sound industries, and now the Tempest platform gives our designers a new freedom to continually innovate and evolve superior algorithms and architectures with the same commitment to distinction as we have in all aspects of our work.

SSL’s SuperAnalogue technology is not an accident, nor is it magic, mythology, or ‘smoke and mirrors’. It is the sum of an applied design philosophy, constant invention, and dedication to optimising every detail of our precision audio products. There are many contributing aspects, including our bespoke circuits, ground-breaking low-noise gain control, servo-coupled amplifier stages, and so on. Here are some of the main features:

Wide Band Audio
We design and test our analogue circuits for a bandwidth way beyond 20kHz, which many other manufacturers consider to be ‘good enough’.

Stable, Low Noise Gain Control
Most manufacturers use VCA (Voltage Controlled Amplifiers) and ‘fixed-reference’ DACs for controlling attenuation or gain - either for convenience, or lower cost, or simplicity. SSL has pioneered the use of M-DACs (Multiplying Digital-to-Analogue Converters) in SuperAnalogue technology, enabling ultra-low noise and precise tracking, even with variable temperatures.

No Electrolytic Capacitors
The physical construction of an electrolytic capacitor means that its performance is imprecise, it is vulnerable to electro-magnetic interference, and even expensive ‘high-quality’ electrolytics do not meet our standards. In addition, over time and with temperature variations, electrolytic capacitors degrade and become ‘leaky’ - resulting in significant noise issues, altered characteristics, and a shortened product life.

SSL avoids using electrolytic capacitors for de-coupling between analogue stages wherever possible. Instead we use advanced DC servo coupling techniques for low noise, high precision DC offset control.

Live: Blink 182
“Other live consoles seem to mimic what’s happening on stage... The SSL gives you what’s really happening.”
Jason Decter, FOH

Broadcast: Zen Broadcast
“System T is by far the best sounding broadcast console I have ever mixed on... It’s a game changer...”
Kevin Duff, Sound Supervisor

solidstatelogic.com
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Low Noise Design
Analogue design is a juggling act that must always balance the power / noise / heat triangle. That is, if you want low power and low heat, you get high noise. If you want low noise, you cannot have low power. While advances in component and power supplies inevitably bring greater efficiencies (a legacy 48-channel SSL 9k console drew nearly 4.5kW while a modern 48-channel Duality console draws about 1.5kW), specifically designing for low power consumption will always result in compromise.

SSL designs precision, low noise music circuits.

Discrete Design
Many modern analogue audio products are the result of the ‘cookbook’ approach - where off-the-shelf blocks are strung together to fulfil a practical brief, but lack the additional details that take them from functional to fantastic. To do that, you have to understand how to augment commercially available components with discrete elements, do original research, and sometimes even design your own components.

SSL does not do ‘datasheet design’ and continues to optimise and improve upon datasheet specifications and ‘serving suggestions’ - we have even licensed our advances back to semiconductor manufacturers. We have built up over 40 years of experience and expertise in improving the canon of analogue music electronics to continually exceed and progress our own high standards.

Audio Switching
Audio switching is extremely common in analogue audio circuits - for everything from switching processing stages in and out to routing, soloing, muting, and so on. SSL uses both relays and an active JFET design with optimised dual-device topology for exceptional distortion-free switching performance.

Transformerless Design
Transformers are an effective component for low audio levels and for bringing character to particular processes, but at line level they introduce low frequency distortion and high frequency roll-off - unless they are physically large enough, which makes them heavy, costly, and space-hungry. SSL uses its own output driver configuration that emulates the floating characteristics of a transformer-coupled output but without the distortion.

Our philosophy is simple. We spare nothing in designing and manufacturing the best precision music tools available anywhere. There is no single design that will work every live, no other song will stand out more than the one that’s mixed on an SSL...”

Nicky Romero, Producer, DJ

Live: Depeche Mode

“You want something that will work every day, sound good, and travel on the truck... So SSL is the only choice.”

Antony King, FOH.

Audio Insight

Multiplexed displays and LEDs in SSL digital products are refreshed at a rate that is a multiple of- and locked to the current operational sample rate. If the console is running at 96kHz, the refresh rate is 384kHz - over 3000 times the refresh rate of an average domestic TV. Any undesirable aliasing imposed on the audio as a result of the display electronics is always reduced to DC... That is, it disappears!
SolidClock™

Jitter is variation in a clock signal that can cause distortion and noise in a digital audio system through a form of frequency modulation. It is a very specific kind of noise, often confused in measurements with harmonic distortion and results in a degree of ‘unease’ in a listener.

To address this, SSL developed SolidClock, an ultra-low jitter clocking technology that guarantees clock deviation of just a few pico-seconds and an accuracy of better than one part per million - exceeding all current standards by a wide margin.

Ultra-low Latency Processing

Latency in digital audio is an inevitable consequence of processing large amounts of data. On many systems, such as DAW-based plug-in platforms, and DSP and FPGA farms, it is often a variable and significant issue.

In the SSL Tempest Engine, almost all processing blocks have a latency of a single sample. That is true however big the block is, and whatever the sample rate of the system is. For example, every FX algorithm in the FX rack (except linear phase processes and algorithms that, by definition, introduce delay) has one sample latency; every movable processing block in a processed path has one sample of latency. If those blocks were not movable and we treated a channel as a single block - that too could have one sample latency. One sample latency at 96kHz equates to 0.01ms of delay.

Broadcast: Canal+

“The sound quality of the whole system is regularly complimented by our operators, and they love the SSL user interface and processing - its high capacity and sonic performance is amazing.”

Jean Marc Delage, Technical Executive

Dynamic Bit Depth

Inside the Tempest Audio Engine bit depth is allocated depending on the needs of the process. There are virtually no limits to digital headroom or precision anywhere in the system and processes are given the resources they need, as they need it.

Runtime Variable Architectures

For the users, the ability to design their own console architecture for any given project is a boon to any production, and a direct result of our multi-core OCP technology. New inputs, outputs, channels, busses, and routings can be created without interrupting audio, and the processed path processing blocks can be moved around in a simple drag-and-drop interface without re-setting the console or muting other channels.

Two Hearts

SSL’s latest digital consoles for live sound and broadcast actually have two hearts – both analogue and digital. The Live consoles – L200, L300, and L500 – and our new broadcast audio production environment – System T – both have Tempest cores, though they built, from the ground up, for their own applications. Both also have SuperAnalogue I/O, available either locally (in the case of the Live products) and through SSL’s Network I/O stageboxes – all of which use SuperAnalogue or mic-pres and output stages.

Tempest – A CPU Audio Engine

The Tempest Engine is an SSL CPU-based design that uses two multicore processors - one dedicated to control and display; the other running a Real Time Operating System (RTOS) with our patented Optimal Core processing (OCP). OCP’s main task is to guarantee deterministic, real-time performance even with heavy memory exchange loads. This enables us to execute multiple complex, high resolution algorithms at very low latency without relying on additional FPGA bus-summing or any extensive external routing hardware. Multiple processing cores are seen as a single processor, which eliminates the ‘farm’ latencies seen in multiprocessor systems. Others often have to sacrifice latency for algorithm quality. There are no such limits for SSL.